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Standardized Hospital Order Sets in Acute Care: A Review of Clinical Evidence, Cost-Effectiveness, and Guidelines

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Abbreviations

AECOPD	Acute exacerbations of chronic pulmonary disease
CHF	coronary heart failure
COPD	chronic obstructive pulmonary disease
CPOE	computerized provider order entry
DKA	diabetic ketoacidosis
EHR	electronic health record
EOL	end of life
LOS	length of stay
RCT	randomized controlled trial
SOS	standardized order set

Context and Policy Issues

In the acute setting, physicians or other providers frequently hand write orders for treatment. These handwritten orders can be ineligible or inappropriate (leading to medication errors), or can create variability in patient care between physicians and patients that is not explained by the patients' condition.[1]

Standardized order sets (SOSs) are clinical decision support tools that aim to help physicians prescribe appropriate treatments using a pre-defined set of applicable drugs and recommended dosages, based off evidence-based guidelines for a specific disease area.[2] SOSs, whether they are inputted electronically (such as through a computerized provider order entry [CPOE] system) or through paper orders, have the potential to reduce medication errors, reduce unnecessary clarification calls between physicians and pharmacists, increase the use of evidence based care, and increase efficient workflow.[2] Additionally, the creation and use of order sets can provide an opportunity to educate physicians on best practices, or to provide reminders on appropriate prescribing and treatment.[3] It is recommended that order sets are complete for the condition they are intended for, reflect the best practice for the disease area, stay up to date on best practices, and are standardized across practitioners.[2]

Despite the potential benefits of SOSs, there can be challenges to implementation. SOSs can have a high initial implementation cost, disrupt regular operations in the hospital setting, and be met with push back from users.[3,4] Hospitals may require a clear benefit of SOSs before investing the time, cost, and effort into implementation.

The objective of this report is to summarize the evidence regarding the clinical and cost effectiveness of SOSs for use in the acute setting, and to summarize evidence-based guidelines and recommendations regarding SOSs. This is to support decision making with regards to the implementation of SOSs in the acute setting, such as in tertiary, community, and regional hospitals, and across multiple jurisdictions.

This report expands on a previous CADTH report, "Standardized Hospital Order Sets in Acute Care: Clinical Evidence, Cost-Effectiveness, and Guidelines", published in 2019.[5]

Research Questions

1. What is the clinical evidence regarding the use of standardized hospital order sets in the acute care setting?

2. What is the cost-effectiveness of the use of standardized hospital order sets in the acute care setting?
3. What are the evidence-based guidelines regarding the use of standardized hospital order sets in the acute care setting?

Key Findings

Evidence from fourteen non-randomized studies suggest that standardized order sets implemented in the acute setting reduced hospital length of stay, reduced mortality, and reduced medication errors. The studies focused on patients with respiratory conditions, diabetic conditions, laryngectomies, EOL care, ischemic stroke, coronary heart failure, or who received vancomycin. No evidence regarding cost-effectiveness and no evidence-based guidelines were identified.

Methods

Literature Search Methods

This report makes use of a literature search strategy developed for a previous CADTH report. For the current report, a limited literature search was conducted by an information specialist on key resources including Medline and PsycINFO via OVID, the Cochrane Library, the University of York Centre for Reviews and Dissemination (CRD) databases, the websites of Canadian and major international health technology agencies, as well as a focused Internet search. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were order sets and acute care. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2014 and June 27, 2019.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Adult and pediatric patients in acute care setting (tertiary, community, and regional hospitals)
Intervention	Standardized order sets for acute care services (including surgery)
Comparator	Usual care, no standardized order sets
Outcomes	Q1: Clinical effectiveness Q2: Cost effectiveness Q3: Guidelines
Study Designs	Health technology assessments, systematic review, meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to 2014. Articles discussing CPOEs as an intervention with no information describing the included order set were excluded. Articles discussing CPOEs with SOSs compared with paper SOSs were excluded. Guidelines with unclear methodology were also excluded.

Critical Appraisal of Individual Studies

The included non-randomized studies were critically appraised using the Down's and Black Checklist.[6] Summary scores were not calculated for the included studies; rather, a review of the strengths and limitations of each included study were described narratively.

Summary of Evidence

Quantity of Research Available

A total of 480 citations were identified in the literature search. Following screening of titles and abstracts, 457 citations were excluded and 23 potentially relevant reports from the electronic search were retrieved for full-text review. 9 potentially relevant publications were retrieved from the grey literature search for full text review. Of these potentially relevant articles, 18 publications were excluded for various reasons, and 14 publications met the inclusion criteria and were included in this report. These comprised 14 non-randomized studies. Appendix 1 presents the PRISMA[7] flowchart of the study selection.

Additional references of potential interest are provided in Appendix 5

Summary of Study Characteristics

Additional details regarding the characteristics of included publications are provided in Appendix 2.

Study Design

All included studies were non-randomized studies.[8-21] One study[13] was a prospective pre-post design and nine studies were retrospective chart reviews or cohort studies (some with a pre-post design). [8,10-12,14-18,20,21]One study was a stepped wedge prospective study,[19] and another was a quasi-experimental cohort study.[9]

The year of publication for the primary studies were 2019,[13,21] 2018,[8,12,14,18,19] 2016,[10] 2015,[9,11,15,16,20] and 2014.[17]

Country of Origin

Ten studies were based in the United States,[9-11,13-17,20,21] and four studies were based in Canada.[8,12,18,19]

Patient Population

All primary studies were set in an acute hospital setting.[8-21] Sample sizes ranged from 70 to 10,938.[8,16]

Seven studies examined patients with respiratory-related conditions.[10,11,13,14,17,19,21] Three studies examined outcomes in patients with chronic obstructive pulmonary disease

(COPD).[10,14,19] This included acute exacerbations of chronic obstructive pulmonary disease (AECOPD).[14,19] Four studies examined other respiratory diseases or conditions, such as asthma,[11,13] pneumonia,[11,17] bronchiolitis[11] and respiratory distress or insufficiency.[21] Two studies examined patients with diabetes and related complications, including type II diabetes[20] and diabetic ketoacidosis (DKA).[12] One study examined patients undergoing laryngectomy or laryngopharyngectomy,[8] one study included patients at end of life (EOL) in the acute care setting,[18] and one study examined patients hospitalized for ischemic stroke.[9] Finally, one study examined patients with coronary heart failure (CHF),[16] and another examined patients who received a dose of the antibiotic vancomycin for any indication.[15]

Eight studies examined outcomes in adult patients (over 18 years of age),[8-10,15-18,20] four in pediatric patients (ages 2 to 17[13], under 1 year,[21], under 17[12] 1 month to 17 years),[11] and two in older adult patients (one with patients who were receiving Medicare and therefore were over 65[14] and one with patients over 45).[19]

Interventions and Comparators

SOSs differed in each study based on the indication or disease area they were intended to be used for.

Eight SOSs were delivered in an electronic format,[10,14-17,19,21] with six studies exclusively including an SOS in a CPOE.[9,15-17,19] Three studies used a combination of paper-based and electronic SOSs,[12] or originally started with paper-based SOSs and switched to electronic during the study period. [13,20] Two studies used exclusively paper-based or pre-printed SOSs.[8,18] One study did not specify the format of the order set.[11]

All studies compared SOSs to ordering without a SOS.[8-21] The majority of these studies defined their comparator as “no order sets”, “usual care”, or “pre-implementation”.[10-12,14-20] Two studies compared SOSs to non-standardized/diverse order sets,[13] or handwritten orders,[8] and one study compared SOSs within an electronic health record (EHR) to solely CPOE without order sets.[21] One study compared SOSs within CPOE and EHR to solely EHR with no CPOE/SOS.[9]

Outcomes

Six studies reported on hospital length of stay,[10,11,14,16,17,19] seven studies on readmission rates,[10,11,13,14,16,17,19] and seven on mortality.[8-10,16,17,19,21] Other reported outcomes included rate of prescribing errors,[8,10] changes to symptom management or medications,[18,20] appropriate medication dosages or monitoring,[12,15,20] complications[8-10,12] comfort at time of death,[18] and hospitalization cost per patient.[11]

Summary of Critical Appraisal

Additional details regarding the strengths and limitations of included publications are provided in .

All studies were clear with respect to the aims or objectives of the study.[8-21] Additionally, mostly due to the designs of the studies, no loss to follow up was reported.[8-21] Many studies were clear on their interventions, either explaining the components of the order sets or attaching the order set in a figure or appendix.[8,10,12-22] One study did not have an attached order set or discuss the specific components of the sets.[11]

Studies with a pre-post design (a design in which the intervention does not occur simultaneously or in a relatively close time period to the control) are at risk from time-

related confounding. This may have been an issue in some studies included in this report,[9-13,20,21] with one study having a three-year delay between collection of control data and collection of intervention data.[15] If a primary treatment, methods in providing treatment, attitudes of physicians, or other variables changed between collection of data for controls (pre-implementation) and intervention (post-implementation), these variables may have biased the results. This biasing may also have occurred in studies that changed the intervention mid way through the implementation phase, (e.g., changing who is responsible for ensuring use of SOS,[13] or changing from paper to electronic formats[13,20]), because it is unclear whether the change occurred due to the introduction of the SOS, or due to the change that occurred during the intervention time period. One study analyzed each addition to the intervention separately from another to attempt to combat this bias.[13] In this study, initially the intervention was paper based SOS, then switched to SOS in a CPOE, then a CPOE SOS with a revised discharge checklist. Each of these different interventions were analyzed separately, and not combined into one "SOS" group.[13]

Retrospective studies may also be limited by bias due to selection of participants. Order sets were not mandatory for physicians to use, and so adherence may have been an issue.[8-10,13,16,17,19] If physicians were more likely to use SOSs for some groups of patients over others (e.g., less severe or complex conditions), the results may be favoured towards order sets due to another unrelated or unmeasured confounder. Confounders were adjusted for or included in the data analysis of three studies.[14,19,20] Five studies did not include a statistical analysis of demographic information,[9,10,13,15,20] or report demographics,[11] so the extent of imbalance of confounders in the initial populations is unknown.

However, the retrospective nature and the method of data collection (through chart review) of the studies included in this report may have mitigated some biases due to Hawthorne effect (i.e., physicians altering their behaviour due to the knowledge of intervention or knowledge of being observed). Physicians in these studies would not have known they were part of a study or known that the order sets were an intervention, so they are likely to have acted in a manner that would reflect real-life implementation of order sets. However, many studies used educational campaigns to facilitate uptake of the new order sets which may have influenced physicians to be more aware of their prescribing patterns and dosages. Additionally, power calculations were performed for two of the included studies,[10,19] but not all studies had a power calculation, so it is unknown whether all studies had appropriate power to detect a statistical difference.

Summary of Findings

Appendix 4 presents a table of the main study findings and authors' conclusions.

Clinical Effectiveness of Standardized Order Sets

Respiratory Conditions

Adult Patients

In adult patients with COPD, prescribing errors were less frequent in patients post-implementation of SOSs.[10] The number of hospitalizations with no prescribing errors was higher (54.3%) with SOSs than with the control (18.6%, $P < 0.001$). Hospital length of stay was also shorter (2.9 days vs. 4 days, $P = 0.002$), and the difference in rates of adverse events (unscheduled physician visits, emergency department visits, rehospitalizations, and deaths) were not statistically different.[10]

In older adults (65 and older) with AECOPD, for implementation of SOSs compared with pre-implementation of SOSs (all patients included), median hospital LOS was 3 days with the SOS and 4 days with no order set (P = 0.02).[14] The SOS was independently associated with LOS (beta = –0.92, P = 0.006) after adjustment for age, sex, race, and smoking status. In another pre-post study of older adults (over 45 years) with AECOPD, there was no difference in median hospital LOS between pre- and post-implementation .[19] A subset analysis in which only included patients that had the order set used in their care compared to patients that did not have an order set used found a significant difference in LOS, favouring the order sets (adjusted median difference in days 0.73, 95% CI 1.40, 0.07). This difference was driven mainly by the hospitalist subgroup.[19] All-cause hospital readmission did not significantly differ between the groups at 30 days or 90 days in either study.[14,19]

In adult patients with pneumonia, the odds of a patient dying without the use of SOS compared with the odds of a patient dying with the use of SOS was 1.787 (95% CI 1.170 to 2.730).[17] A chi-squared statistical test failed to find a significant difference in mortality between the SOS group and control (P = 0.061), but a Fisher's exact test found slight significance (P = 0.05).[17] The percentage of patients returning to the hospital after 30 days was significantly lower in the SOS group when compared with the control (odds ratio [OR] = 1.362, 95% CI 1.015 to 1.827, P [chi square] = 0.039, P [Fisher's] = 0.041). The LOS was also significantly shorter in the SOS group, at 4.32 days (compared with 4.79 days, P = 0.009), consistent with results for other respiratory conditions in adults.[17]

Pediatric Patients

In a study of pediatric patients with asthma, hospital length of stay (LOS) was significantly reduced when a CPOE-based SOS was implemented in a stepwise introduction (each group had order sets introduced at different times, sequentially, with each group acting as their own control group).[13] The introduction of a paper-based SOS was associated with a non-significant 7.2% decrease in LOS (P = 0.56). The introduction of a CPOE based SOS to replace the paper-based SOS was associated with a significant 37% decrease in LOS (P = 0.02). After the introduction of the CPOE based SOS, the discharge checklist within the intervention was revised, and after introduction of the revised checklist there was a non significant 4% increase in LOS.[13] All comparisons between the four time periods (i.e., no intervention, paper-based SOS, CPOE SOS, and CPOE SOS with revised checklist) were significant except between the implementation of paper based order sets and a CPOE based order set.[13] In another study examining pediatric patients with asthma comparing an SOS and asthma clinical pathway with no order sets, hospital LOS was reduced significantly (P < 0.05) from 1.9 days to 1.45 days. In patients with bronchiolitis and pneumonia, LOS was also reduced, from 2.37 days to 2.04 days and 2.30 days to 2.10 days respectively, although reduction in LOS for pneumonia was not significant (P = 0.083 for pneumonia, P < 0.05 for bronchiolitis).[11]

30-day readmissions were reduced for patients with pneumonia, asthma, and bronchiolitis, but changes were not statistically significant..[11]

For respiratory distress, in pediatric patients less than one year of age requiring enteral nutrition (EN), initiation of EN within 48 hours was significantly higher in groups using SOS (81% vs. 63%, P < 0.01) and time to initiation of EN was significantly shorter (1.3 days vs. 1.7 days, P < 0.0001) when comparing a SOS within an EHR to a CPOE with no SOS.[21] Weight gain for infants was significantly larger in the SOS group (140 g vs. 80 g, P = 0.001) and LOS was shorter in the pediatric intensive care unit (156 hours vs 202 hours, P <

0.0001).[21] Total hospital LOS was longer in the SOS group (8.7 days vs. 8.4 days) but this was not statistically significant. There were no mortalities in either group.[21]

Diabetic Conditions

In adults diagnosed with type II diabetes, there was no significant change in the incidence of moderate or severe hypoglycemia (P = 0.15, 0.38). Blood glucose levels decreased significantly more in groups using a SOS compared with no SOS (P = 0.020).[20]

In pediatric patients with DKA, the number of moderate or severe hypokalemia episodes were not significantly different between SOS groups and non-SOS groups (P = 0.70).[12] Episodes of hypoglycemia also did not differ between the groups (P = 0.99).[12]

Other Conditions

In adult patients undergoing surgery on the larynx and pharynx, errors in antibiotic ordering was significantly lower in the group using SOSs when compared to the group not using SOSs (38.2% vs. 80.6%, P < 0.0001).[8] Secondary outcomes, including post-operative complications, number of fistula, number of surgical revisions, thromboembolic disease, number of salivary bypass tubes, and number of deaths were not significantly different between the groups.[8] Although not tested statistically, numerically, mean LOS was exactly the same (18.6 days) in each group.[8]

In adult patients receiving EOL care in the acute setting, SOS groups had significantly fewer mean adjustments to EOL symptom management (1.7 vs. 3.3, P = 0.00014).[18] Patients comfort status at death was more often rated as “comfortable” for patients who had care managed using a comfort measures order set, but this was not significant (P = 0.11).[18]

An order set for patient hospitalizations for ischemic stroke significantly reduced 30-day, 60-day, and 90-day mortality, but did not significantly lower in hospital or 7 day mortality.[9] Use of the order set also lowered rates of pneumonia in patients hospitalized for ischemic stroke.[9]

In patients with coronary heart failure, mortality was significantly lower in the groups using SOSs (1.8% vs. 3.2%, P = 0.04 [Fisher’s]), but there was no significant difference in 30-day hospital readmissions (P = 0.424 [Fisher’s]). LOS was significantly shorter in the SOS group (P = 0.004).[16]

Finally, in patients receiving vancomycin as an antibiotic for any indication in the acute setting the percentage of patients receiving an appropriate dose was higher post implementation of a CPOE with an order set when compared to pre-implementation (P < 0.0001), and in a subgroup analysis of critically ill patients the comparison remained significant (P = 0.0441).[15]

Cost-Effectiveness

No relevant evidence regarding cost effectiveness of SOSs was identified; therefore, no summary regarding cost-effectiveness can be provided.

Although no evidence on cost-effectiveness was identified, in one study, hospitalization costs associated with the SOS (US$1174) for pneumonia, bronchiolitis, and asthma were lower in comparison to no SOS (US$2010), but this was not statistically tested.[11]

Guidelines and Recommendation for Standardized Order Sets

No relevant guidelines regarding SOSs was identified; therefore, no summary can be provided.

Limitations

Many of the included studies were set in single-centres or single-hospitals, which may limit generalizability to other settings or centres. Despite this, four studies were conducted in Canada, and the remaining studies in the USA, which may assist in generalizability to a North American context.[8,12,18,19]

Additionally, the majority of studies were conducted with patients with respiratory issues or conditions.[10,11,13,14,17,19,21] Although there were other studies examining other conditions, not all conditions that would be seen in an acute hospital were included. This limits the conclusions that can be made about these other indications, as each order set is specific to the indication they are used for or the setting they are used in and not a general order set for every indication. Therefore, the order sets evaluated in this report may not generalize to other indications, and order sets specifically made for other indications may not have the same results as ones included in this report.

Finally, no cost effectiveness studies with appropriate interventions or comparators were identified, therefore no conclusions regarding the cost of implementation or cost effectiveness of SOS could be made. No guidelines regarding the use of SOS were identified, therefore no specific recommendations were available for the analysis.

Conclusions and Implications for Decision or Policy Making

Fourteen non-randomized studies were identified regarding SOSs in the acute setting.[8-21] Seven studies examined patients with respiratory conditions,[10,11,13,14,17,21] and two with diabetic conditions.[12,20] The remaining studies examined patients undergoing laryngectomy,[8] EOL care,[18] ischemic stroke care,[9] CHF care,[16] or receipt of vanomycin.[15] Overall, SOSs significantly lowered hospital LOS when compared to no order sets. Mortality was also lowered overall with the use of the order sets. Errors in medication dosages and types were also generally lower with the use of order sets, and complications were not generally different between the groups. Hypoglycemic events did not appear to differ between SOS groups and no SOS groups in patients with diabetes.

Challenges and limitations of the included studies were the non-randomized nature of all of the studies, the retrospective study design of some included studies, and the threats to internal validity of confounding variables, including time-related confounding and selection bias. Additionally, the studies were single centre studies that may not generalize to every setting. Four studies were conducted in a Canadian setting, which may aid in generalizability to the Canadian context.[8,12,18,19]

Further research addressing SOSs in different indications may help to reduce uncertainty regarding generalizability. Research regarding the cost-effectiveness of SOSs was also lacking, as no specific cost-effectiveness studies were identified to address this. Guidelines and recommendations regarding SOSs for indications would also be beneficial to assist in design and implementation of SOSs in the acute setting.

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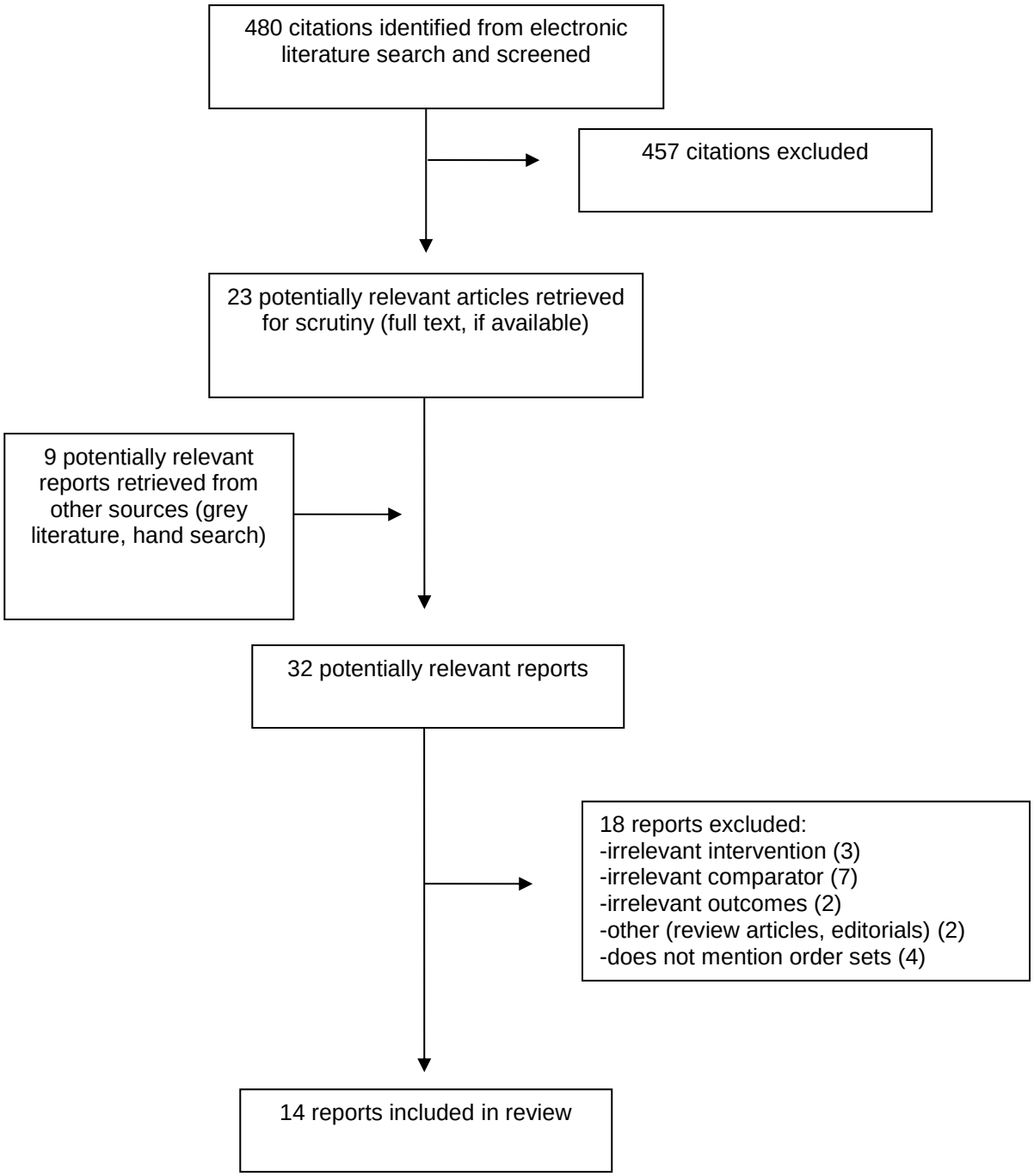
Appendix 1: Selection of Included Studies



Appendix 2: Characteristics of Included Publications

Table 2: Characteristics of Included Primary Clinical Studies

First Author, Publication Year, Country	Study Design	Population Characteristics, Setting	Intervention and Comparator(s)	Clinical Outcomes, Length of Intervention
Gellert 2019[13] **USA**	Pre-post design	Children aged 2 to 17 with asthma, with no other chronic respiratory disease ED of Children's Hospital of San Antonio	**Intervention** Paper based CHAT Asthma Management Pathway using CRS and SOS CHAT Asthma Management Pathway integrated into CPOE (with a standardized discharge checklist) **Comparator** Non-standardized or multiple/diverse paper order sets	LOS Hospital readmission rate (30 days and 100 days) Time to first beta-agonist administration from ED Time to first steroid administration from ED 50 months (27 May 2013 to 27 July 2017) Non-standard order sets (prior to January 2014) – Period 1 Paper-based SOS from January 2014 to November 2014 – Period 2 CPOE from November 2014 to August 2015 – Period 3 CPOE with revised checklist from August 2015 to July 2017– Period 4
Ziemba 2019[21] **USA**	Retrospective chart review	Pediatric patients < 1 year of age with respiratory distress and/or insufficiency Pediatric intensive care unit in a quaternary referral hospital	**Intervention** Standardized order set (EN algorithm) within an EHR **Comparator** CPOE without CDST or feeding order set	Mortality Time to EN Number reaching and time to goal EN Hospital LOS Weight gain December 2015 to February 2017
Ansari 2018[8] **Canada**	Retrospective chart review	Patients undergoing laryngectomy or laryngopharyngectomy	**Intervention** Standardized order sets **Comparator** Handwritten orders	Percentage of cases with at least one error or deviation from standard practice Postoperative complications (thromboembolic disease, return to the operating room, fistula formation, salivary bypass tube) Hospital LOS Death within 30 days of the operation January 2010 and December 2012

Table 2: Characteristics of Included Primary Clinical Studies

First Author, Publication Year, Country	Study Design	Population Characteristics, Setting	Intervention and Comparator(s)	Clinical Outcomes, Length of Intervention
Flood 2018[12] **Canada**	Retrospective chart review	Patients aged 0 to 17 years with discharge diagnoses according to the International Statistical Classification of Diseases and Related Health Problems (10th revision) for DKA Royal University Hospital, provincial pediatric tertiary care hospital	**Intervention** Paper and digital evidence-guided DKA order set ("Pediatric Diabetic Ketoacidosis-Therapy Initiation Order Set") **Comparator** Pre-implementation (no DKA order set)	Appropriate fluid bolus volumes and replacement rates Initial potassium management Timely dextrose supplementation Complications of management 12-month implementation phase April 2014 to September 2016 for pre-intervention September 2016 to October 2017
Gulati 2018[14] **USA**	Retrospective cohort study	Medicare recipients with an AECOPD diagnosis University Hospital	**Intervention** COPD PowerPlan (standardized EHS-based order set) **Comparator** "Usual care" (no powerplan)	Cumulative SC dose LOS Duration of intravenous steroid use Dose and duration of oral prednisone use All-cause hospital readmission rates (30 and 90 days) January 2014 to December 2016
Lau 2018[18] **Canada**	Retrospective chart review	Patients who were referred to the PCCT in acute care under oncology and GIM for EOL care Sunnybrook Health Science Centre, acute care hospital	**Intervention** Paper comfort measures order set **Comparator** No comfort measure order set	Frequency of initiated medications to ease EOL Changes to symptom management Comfort at time of death 12 months implementation
Pendharkar 2018[19] **Canada**	Stepped wedge prospective non-randomized cluster trial	Patients over 45 years of age with AECOPD admitted to the pulmonary, general internal medicine or hospitalist clinical services excluded if admitted to the ICU Tertiary-care teaching hospital	**Intervention** Computerized AECOPD order set **Comparator** Historical controls from 12 months prior to implementation	LOS All-cause readmissions at 7, 30 and 90 days after discharge ED visits at 7 and 30 days In-hospital mortality March 2013 to March 2015

Table 2: Characteristics of Included Primary Clinical Studies

First Author, Publication Year, Country	Study Design	Population Characteristics, Setting	Intervention and Comparator(s)	Clinical Outcomes, Length of Intervention
Brown 2016[10] **USA**	Retrospective chart review	Patients discharged with a primary diagnosis of a COPD exacerbation during a 1-year period before order set implementation and for 6 months after order set implementation Minneapolis Veterans Administration Health Care System, tertiary care teaching facility	**Intervention** COPD order set with a clinical decision support system for antibiotics for acute bronchitis in patients with COPD **Comparator** Pre-implementation (no order set)	Rate of zero prescribing errors by physicians for inpatient and discharge drugs for COPD over a 1-year period before implementation and for 6 months after implementation Percentage of prescribing errors in each of the five drug therapy categories Hospital LOS 30-day post discharge clinical outcomes (unscheduled primary care visits, emergency department visits, rehospitalizations, deaths) Pre-implementation October 2009 to September 2010 Postimplementation May 2012 to November 2012.
Ballard 2015[9] **USA**	Quasi-experimental cohort study	Adults (> 18 years of age) who visited an ED that resulted in a hospitalized for ischemic stroke Medical centre	**Intervention** ED stroke order set with CPOE-EHR **Comparator** Documentation-only EHR, no CPOE	IV tPA administration Hospital acquired pneumonia Short term mortality 2006 to 2012, staggered
Dayal 2015[11] **USA**	Retrospective pre-post study	Pediatric patients 1 month to 17 years with primary diagnosis of asthma, bronchiolitis, or pneumonia Community hospital	**Intervention** Evidence based order sets and an asthma clinical care pathway **Comparator** No order sets (before implementation)	Medication utilization Hospitalization cost per patient Mean LOS 30-day readmission rate Pre-implementation from January 2008 to December 2009 Implementation from January 2010 to December 2011* **pre-education and implementation occurred in September 2009 and October 2009 respectively*
Hall 2015[15] **USA**	Retrospective cohort study	Patients aged 18 years and older who received a dose of vancomycin	**Intervention** Vancomycin weight-based electronic order set	Appropriate initial ED vancomycin doses Vancomycin doses in critically ill patients

Table 2: Characteristics of Included Primary Clinical Studies

First Author, Publication Year, Country	Study Design	Population Characteristics, Setting	Intervention and Comparator(s)	Clinical Outcomes, Length of Intervention
		ED at tertiary care hospital	**Comparator** No CPOE	Pre CPOE: June 2010 to August 31, 2010 Post CPOE: January 2013 to March 2013
Krive 2015[17] **USA**	Retrospective cohort study	Patients (> 18 years) with primary or secondary diagnosis of community-acquired pneumonia City and suburban community care hospitals	**Intervention** Electronic pneumonia order sets **Comparator** "No order set"	Health outcomes 30-day readmissions Length of hospital stay Mortality Comorbidities Five years (2007–2011)
Valgardson 2015[20] **USA**	Quality improvement retrospective record review	Hospital admissions (>18 years) with prior diagnosis of type II diabetes Gallup Indian Medical Center, rural hospital	**Intervention** Insulin order set (originally paper then electronic) **Comparator** No order set	Use of sliding-scale insulin monotherapy BBC insulin use Use of any basal insulin during hospitalization Change in use of non-recommended insulin regimens Appropriate monitoring of hemoglobin A1c Change in orders for oral antihyperglycemic agents during admission Glycemic control (mean daily blood glucose and hypoglycemia, both moderate (blood glucose <70 mg/dL) and severe (blood glucose <40 mg/dL)) 4-month period before implementation (January 2011, to April 2011) 4-month period after implementation (January 2012, to April 2012)
Krive 2014[16] **USA**	Retrospective cohort study	Patients (>18) with primary or secondary diagnosis of CHF City and suburban community care hospitals	**Intervention** Electronic CHF order set **Comparator** "No order set"	Health outcomes 30-day readmissions Length of hospital stay Mortality Comorbidities Five years (2007–2011)

AECOPD = acute exacerbations of chronic obstructive pulmonary disease; CDST = clinical decision support tool; CHF = coronary heart failure; COPD = chronic obstructive pulmonary disease; CPOE = clinical provider/physician ordered entry; CRS = clinical respiratory score; DKA = diabetic ketoacidosis; ED = emergency department; EHR = electronic health record; EHS = electronic health system; EN = enteral nutrition; EOL = end of life; GesTIO = management of insulin therapy in hospital; GIM = general internal medicine; ICU = intensive care unit; IV = intravenous; LOS = length of stay; PCCT = palliative care consult team; tPA = tissue plasminogen activator; RCT = randomized controlled trial; SOS = standardized order set

Appendix 3: Critical Appraisal of Included Publications

Table 3: Strengths and Limitations of Clinical Studies using Down's and Black Checklist[6]

Strengths	Limitations
Gellert 2019 [13]	
- Aims of study clear - Main outcomes clearly described - Intervention of interest described with attached order set - No loss to follow-up due to study design - Inclusion and exclusion criteria of patients clear - As components were introduced separately at different time periods, it is clear to see the specific impact each component has on the outcomes - Actual probability values reported - No loss to follow-up due to study design - Inclusion and exclusion criteria of patients clear - P values for multiple comparisons were adjusted using Bonferroni correction	- Changes in protocol mid-intervention – e.g., originally physicians nurse and respiratory therapist responsible for ensuring use of discharge checklist but switched to discharge nurse due to inadequate completion. This is unclear if this was at the time of the refined discharge order set implementation. - No comparison of demographics or patient characteristics between patients seen in each time period. Some demographics information provided with no numbers supporting them (e.g., socioeconomic status). Unknown if selection bias present in the groups. - Pre-post study design does not consider impact of time on groups – care from pre-intervention may differ slightly from care in post-intervention (i.e., history threats to validity). - There was a trend to lower LOS in P1 before the introduction of the intervention. With no direct control group occurring simultaneously, unknown if downward trend already occurring intervention would have continued occurring without introduction of the intervention - Values below 10 h and above 100h were excluded from the analysis but this was not justified (there were several values above and below these points) - Use of the CPOE/checklists was not mandatory, therefore adherence was an issue – e.g., use rate was ~85% for the CPOE over the study period
Ziemba 2019 [21]	
- Aims of study clear - Main outcomes clearly described - Intervention of interest described with attached order set - Main finding clearly described - Statistical tests described and appropriate (Mann-Whitney U test) - Data distributions reported - non-parametric data set, tested with Shapiro Wilk normality test. Appropriate median values used. - Adherence to protocol likely to be higher at beginning of protocol introduction (and participant more likely to think of enteral nutrition for patients), but the long follow-up time of 1 year and 2 months likely mitigated this effect - Actual probability values reported - No loss to follow-up due to study design - Inclusion and exclusion criteria of patients clear	- No adjustment for confounding, weight changes in the PICU may have been due to other factors (acknowledged by the authors that weight in the PICU fluctuates frequently) - Pre-post study design does not consider impact of time on groups – care from pre-intervention may differ slightly from care in post-intervention (i.e., history threats to validity) - Single centre study may not generalize outside of this specific centre - Both CDST and SOS used in conjuncture, therefore unknown whether improvements because of CDST, SOS or both in combination - Children in pre-intervention had significantly lower weight than in post-intervention - No randomization of patients or provider to treatment groups due to study design

Table 3: Strengths and Limitations of Clinical Studies using Down's and Black Checklist[6]

Strengths	Limitations
	- Not clear what was in place prior to implementation of the SOS and CDST – the hospital had a CPOE in place but unclear what was included in the CPOE - Adherence with intervention unknown as the alert for the order set was a best-practice advisory and as such could be overridden by the physician (i.e., intervention was not mandatory) - Retrospective design may lead to biases in results
Ansari 2018 [8]	
- Relevant demographic information provided and statistically tested - Time related confounding may not have occurred as the intervention and comparator occurred simultaneously - Intervention of interest described with attached order set - Actual probability values reported - No loss to follow-up due to study design - Inclusion and exclusion criteria of patients clear - Appropriate Fisher's Exact test used for small sample sizes and categorical demographic data - Retrospective design may eliminate potential for Hawthorne effect	- Sample size was smaller in comparison to other studies of the same type (n = 70), which may have contributed to a lack of statistical significance. No power calculations were performed. - Use of order set was at discretion of physician – may have been influenced by other factors such as severity of disease or physician preference. - Single centre study may not generalize outside of this specific centre - Hospital LOS not statistically tested (although, unlikely to affect the results as they were the same length of time) - Physicians not using the order sets may have been more likely to have been performing additional pharyngectomies, thyroidectomies or free flap, which require more complex ordering/procedures - Retrospective design may lead to biases in results
Flood 2018 [12]	
- Aims of study clear - Main outcomes clearly described - Intervention of interest described with order set components - No loss to follow-up due to study design - Inclusion and exclusion criteria of patients clear -	- Retrospective study design does not consider impact of time on groups – care from pre-intervention may differ slightly from care in post-intervention (i.e., history threats to validity). - Confounding not considered nor adjusted for - Not all outcomes tested statistically - Retrospective design may lead to biases in results
Gulati 2018[14]	
- Aims of study clear - Patient demographics reported and tested statistically between groups - Intervention of interest described with order set components - Multivariate analysis used to test for association of factors that differed between groups to choose to use the SOS, and found to be not be significant - Multiple regression model used, and confounders adjusted for - Normality tested for with data sets - No losses to follow-up due to study design - No conflicts of interest	- Some values differ between text and tables – e.g., mean age of whole cohort transcribed as 62 in text and 69 in table, FEV1 score differ (55.1% vs. 53%) - Some value in tables and text do not follow from each other – e.g. 38 out of 72 participants were male, but this is written as 33%. - Number of white participants provided but no information on the other ethnicities in remaining 29% of cohort - Means used for all outcomes except LOS, but not explained why. Unknown if appropriate non-parametric test used for this outcome (other tests done using t-tests, not clear for LOS).

Table 3: Strengths and Limitations of Clinical Studies using Down's and Black Checklist[6]

Strengths	Limitations
	- Usual care cohort had less participants with ≥ 1 AECOPD within the previous months, and SOS group has higher history of smoking, so there were some differences in baseline characteristics of participants - Patients assigned to intervention based on characteristic, physician preference - Other COPD interventions not taken into account (e.g., home oxygen use, steroid use), unknown if these may have affected the selection of intervention - Retrospective design may lead to biases in results
Lau 2018[18]	
- Aims of study clear - Patient demographics reported and tested statistically between groups - Actual P values reported - Design of study allowed for simultaneous comparison of CMOS and control, which may eliminate some time-related biases - No loss to follow-up due to study design - Inclusion and exclusion criteria of patients clear - Intervention of interest described with attached order set	- Unclear what protocol was for control group – no order set, but not clear who was responsible for care in the control setting - Some results reported in graphical form with no specific numbers - CMOS was initiated by the responsible physician – the CMOS group therefore may have been more likely to receive CMOS for a reason related to their condition or to the physician's preferences - Confounding not adjusted for - Not all outcomes tested statistically (or not reported) - Retrospective design may lead to biases in results
Pendharkar 2018 [19]	
- Stepped wedge design used to minimize timing related confounding - Some aspects of confounding considered in statistical analysis using covariates in regression model - Each cluster acted as its own control, with multiple clusters analysed. - Power calculation performed with 80% power and 0.05 alpha - Appropriate two-sample/paired statistical analyses conducted, with non-parametric medians used due to skewed data - Order sets tested with different physician groups, increasing potential generalizability of results - Intervention of interest described with attached order set	- Order set use by each individual physician was voluntary, so adherence may have been an issue - Monthly statistics on order set use were posted in clinical areas, which may have influenced order set use - Order set use was up to physician's discretion – may have been influenced by other factors such as severity of disease or physician preference. -
Brown 2016 [10]	
- Sample size calculation performed with alpha of 0.05 and power of 80% - Aims of study clear - Intervention of interest described with order set components - No losses to follow-up due to study design - No conflicts of interest	- Unclear what procedure was pre-implementation - Unit of analysis was hospital admission (readmission treated as separate data points), so effects of clustering of the same patients not taken into account - Pre-post study design does not consider impact of time on groups – care from pre-intervention may differ

Table 3: Strengths and Limitations of Clinical Studies using Down's and Black Checklist[6]

Strengths	Limitations
	slightly from care in post-intervention (i.e., history threats to validity) - Single centre study may not generalize outside of this specific centre - Order set use optional by physicians which may affect adherence and selection (66% of physician use - Study did not have the statistical power to detect effects on some of the outcomes at 30 days (rehospitalizations, recurrent exacerbations, or mortality) - No statistical comparison of demographics before and after implementation
Ballard 2015 [9]	
- Appropriate parametric and non-parametric tests used for different data distributions - Use of stroke order set evaluated in supplementary – not just availability of set, so changes likely due to use of set - Demographics of individuals receiving the stroke order set visually appeared to be similar - Intervention of interest described with attached order set components	- Stroke order set use not mandatory for physicians, so adherence may have been an issue. - Stroke management may have changed over the course of the study and time-related confounding may have been an issue - Other confounding factors such as severity of stroke symptoms may have influenced the use of the stroke order set - Demographics of included patients were not tested statistically
Dayal 2015 [11]	
- Aims of study clear - Inclusion criteria clear - Intervention of interest described - No losses to follow-up due to study design - No conflicts of interest - Statistical test likely appropriate for data	- Pre-implementation time period stated to be from Jan 2008 to Dec 2009, but order sets were initiated, and education provided in September and October of 2008. This overlap of dates is not explained. - No demographic information reported - Time periods compared differ between outcomes, this is not explained – e.g., for primary outcomes pre-implementation was between 2009 and 2010, but costs were in 2009 only, and for post-implementation. Primary outcomes were between 2010 and 2011, but costs were 2011 only. As costs can change over time in hospitals and per year, data was omitted that could have affected the results - Pharmacy utilization data only available between 2008 and 2010 - Pre-post study design does not consider impact of time on groups – care from pre-intervention may differ slightly from care in post-intervention (i.e., history threats to validity) -
Hall 2015[15]	
- Primary objective clear - Relevant demographic information reported - No losses to follow-up due to study design	- Protocol pre-CPOE is unclear. Unclear if order sets were used non-electronic sets in hospital - No sample size calculation. - Retrospective design may lead to biases in results

Table 3: Strengths and Limitations of Clinical Studies using Down's and Black Checklist[6]

Strengths	Limitations
- Subgroup analyses performed on indications and weight groups - Intervention of interest described with components	- Demographic information not tested statistically - Three-year delay between data for pre-CPOE and post-CPOE may lead to time-related confounding, if practice had changed within that time period - No conflicts of interest statement reported
Krive 2015 [17]	
- Intervention of interest described with order set components - Appropriate logistic regression modeling used for binary outcomes - Aims of study clear - No time related confounding as both intervention and comparator occurred in the same time period	- No demographics were reported or compared - Adherence of order set was low - Uses the acronym "CF" for what is assumed to be confidence interval but does not define it, this is unclear - Chi square test used originally (no significance found) and fisher's exact test used afterwards ("due to small sample sizes") to find significance. The cut-off for "small sample size" was not determined *a priori* - Results written in a misleading way – e.g., *"The binary logistic regression method revealed that 6.6% of patients in the order set group (N = 362) died versus 11.3% in the no order set group (N = 4,725),"* (p8) This seems like the number of deaths in each group came from a regression model, when in actuality they came from ICD-9 codes in the patient files. - Pneumonia patients were assigned to the order set and no order set groups based on their diagnosis and physicians' ordering preferences - CCI score used for complications but the score does not differentiate between complications that were already present and those that occurred during the hospital stay. This makes interpretation of this outcome very difficult. Patients in the order set group may have been healthier upon admission to hospital compared with the no order set group. - Means used with Mann Whitney U test, reasoning not explained, distribution of comorbidity data not discussed - Retrospective study design does not allow for control of potential confounding variables in the two groups
Valgardson 2015[20]	
- Aims of study clear - Relevant demographics information reported - Educational sessions used to explain proper use of order sets - Mean daily blood glucose adjusted for confounders - Intervention of interest described with order set components - Multiple time points taken to adjust for temporal changes in daily glucose levels - Unit of analysis was hospital admission (readmission treated as separate data points), but standard errors	- Pre-post study design does not consider impact of time on groups – care from pre-intervention may differ slightly from care in post-intervention (i.e., history threats to validity) - Single centre study may not be generalizable to other settings - Demographics information not statistically tested - Retrospective study design does not allow for control of potential unmeasured confounding variables in the two groups

Table 3: Strengths and Limitations of Clinical Studies using Down's and Black Checklist[6]

Strengths	Limitations
were adjusted for the correlation of observations within individuals Intervention of interest described with attached order set	
Krive 2014[16]	
- Intervention of interest described with order set components - Appropriate logistic regression modeling used for binary outcomes - Aims of study clear - No time related confounding as both intervention and comparator occurred in the same time period	- No demographics were reported or compared - Adherence of order set was low - Uses the acronym "CF" for what is assumed to be confidence interval but does not define it. - Chi square test used originally (no significance found) and fisher's exact test used afterwards ("due to small sample sizes") to find significance. The cut-off for "small sample size" was not determined *a priori* - Results written in a misleading way – e.g., *"The binary logistic regression method revealed that 1.8% of patients in the "order set" group died versus 3.2% in the "free text" group"* (*p*821) This seems like the number of deaths in each group came from a regression model, when in actuality they came from ICD-9 codes in the patient files. - Pneumonia patients were assigned to the order set and no order set groups based on their diagnosis and physicians' ordering preferences - CCI score used for complications but the score does not differentiate between complications that were already present and those that occurred during the hospital stay. This makes interpretation of this outcome very difficult. Patients in the order set group may have been healthier upon admission to hospital compared with the no order set group. - Means used with Mann Whitney U test, reasoning not explained, distribution of comorbidity data not discussed - Retrospective study design does not allow for control of potential unmeasured confounding variables in the two groups

AECOPD = acute exacerbation chronic obstructive pulmonary disease; CCI = clinical comorbidities index; CDST = clinical decision support tool; CMOS = comfort measures order set; CPOE = computerized provider order entry; ICD-9 = International Classification of Diseases, Ninth Revision; FEV1 = forced expiratory volume; LOS = length of stay; PICU = pediatric intensive care unit; SOS = standardized order set

Appendix 4: Main Study Findings and Authors' Conclusions

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Gellert 2019 [13]	
Demographics N = 1494 visits total, 1223 unique patients **Age** 2 to 6 years: 56% 7 to 11 years: 33% 12 to 17 years: 11% **Sex** Male: 60% Female 40% **Ethnicity** Hispanic: 77% African American: 16% **Insurance type** Medicaid: 79% Commercial insurance: 8% Preferred provider organization: 5% Self pay: 4% Tricare: 2% Other: 2% *"…disproportionately of low SES" Page 8* *Note:* *Period 1 (P1) - Non-standard order sets* *Period 2 (P2) - Paper-based SOS* *Period 3 (P3) - CPOE + SOS + discharge checklist* *Period 4 (P4) - CPOE + SOS + revised checklist* CPOE month over month use rate was 83 to 89% (mean of 85%) Discharge checklist use rate increase 18% to 72% **Primary Outcome** LOS (geometric mean, hours), general linear model - P1: 34.8 (95% CI 32.2, 37.6) - P2: 29.3 (95% CI: 27.5, 31.3) - P3: 29.0 (95% CI: 27.0, 31.3) - P4: 23.1 (95% CI: 22.1, 24.2) **Pairwise comparisons between study periods:** All significant (adjusted P < 0.05), except P2 vs. P3 (P = 0.83) Change in LOS was affected by the study period (P1,2,3,4) – i.e., slope of linear regression depended on which study period observed (significant, P = 0.015)	*"We observed a substantial reduction in hospital length of stay associated with utilization of an evidence based, best practice asthma management pathway incorporating a CRS, first via paper order sets and then within CPOE, combined with a tool to expedite appropriate discharge. In addition, there was a significant reduction in the proportion of patients who were readmitted within 100 days of the initial hospital visit. To our knowledge, this is one of the first studies to demonstrate improved, reduced LOS and 100-day hospital readmissions within a predominantly Hispanic, lower SES and publicly insured patient population. The time to first administration of a betaagonist and first administration of a steroid did not decrease during the study period and remain critical objectives for further quality improvement efforts to improve our asthma outcomes."* (*p*11) *"These findings demonstrate that as the multidisciplinary care team was able to decrease the length of stay for patients treated for asthma in the facility, these efforts did not cause a concomitant increase in readmission rates by discharging patients too soon with respect to their clinical status and readiness to go home"* (*p*10)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion

"LOS tended to decrease within each process improvement period" Page 9
 	
During P1, a one-year increase in time was associated with a 38% **decrease** in LOS, P = 0.054
- Geometric mean, May 2013: 40.8h
- Geometric mean, December 2013: 30.7h
  ○ 24.8% decrease
 	
During P2, a one-year increase in time was associated with a 7.2% **decrease** in LOS, P = 0.56
- Geometric mean, January 2014: 30.2h
- Geometric mean, October 2014: 28.4h
 	
During P3, a one-year increase in time was associated with a 37% **decrease** in LOS, P = 0.02
- Geometric mean, November 2014: 33.8h
- Geometric mean, July 2015: 24.3h
  ○ 28.1% decrease
 	
During P4, a one-year increase in time was associated with a 4% **increase** in LOS, P = 0.33
 	
Secondary Outcomes
Time to beta-agonist or steroid administration
No statistically significant improvement or deterioration of time to therapeutics over observation time-period
 	
Hospital readmission rates
 	
30 days readmission, proportion (%)
P1: 1.06
P2: 1.06
P3: 0.48
P4: 0.74
 	
P = 0.83
 	
100 days readmission, proportion (%)
P1: 7.4
P2: 2.1, adjusted P = 0.04*
P3: 3.9, adjusted P = 0.53*
P4: 2.2, adjusted P = 0.01*
*all p values compared with P1
Comparisons of P2, P3, and P4 non-significant, P ≥ 0.064
Significant decrease between beginning and end of study period P = 0.008	

Ziemba 2019 [21]	
Demographics N = 647	*"Regardless, our QI initiative serves to demonstrate that use of CDSTs and a*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
No SOS n = 375 SOS n = 272 Female (n, [%]; no SOS vs. SOS): 141 [39] vs. 106 [39], P = 0.65 Ethnicity (n, [%]; no SOS vs. SOS): - African: 7 [2] vs. 10 [4] - Asian: 2 [1] vs. 3 [1] - Latino: 21 [6] vs. 14[5] - Multiracial: 22 [6] vs. 16 [6] - Black: 84 [22] vs. 54 [20] - White: 227 [60] vs. 166 [61] - Unknown: 11 [3] vs. 8 [3] PRISM Score (median; no SOS vs. SOS): 2 vs. 2, P = 0.31 Age (month; no SOS vs. SOS): 2 vs. 3, P = 0.11 Weight (kg; no SOS vs. SOS): 5.1 vs. 6.1, P = 0.01 **Outcomes** **Initiation of EN within 48 hours (%), no SOS vs. SOS** 63% vs. 81%, P < 0.01 **Time to initiation of EN (median, days), no SOS vs. SOS** 1.7 vs. 1.3, P < 0.0001 **Achievement of goal EN, no SOS vs. SOS** *Time to achievement, (median, days):* 2.8 vs. 2.2, P < 0.0001 *Children reaching goal EN (%):* 18 vs. 38, P < 0.01 **Weight gain (median, g), no SOS vs. SOS** 80 vs 140, P = 0.001 **LOS, non-SOS vs. SOS** *Total hospital LOS (median, days):* 8.4 vs. 8.7, P = 0.93 *PICU stay (median, hours):* 202 vs. 156, P < 0.0001 No mortalities in either group	*standardized order set is both feasible and potentially impactful when used in conjunction with clinical protocols. In conclusion, this study demonstrates that the use of specific CDST can facilitate the implementation of a physician-ordered and nursing driven protocol to enhance the care of critically ill pediatric patients."* (*p*5)
Ansari 2018 [8]	
Demographics N = 70 SOS n = 34 No SOS n = 36 **Age, mean ± SD, year** SOS: 63.4 ± 9.6 No SOS: 62.7 ± 11.1 P = 1 **Sex, male, %**	*"The goal of this study was to determine if standardized order sets reduce immediate postlaryngectomy order omissions or errors. 80.6% of handwritten orders had at least one deviation from the standard of care guidelines compared to 38.2%in the standardized order set group. This statistically significant result provides evidence that there is an association between the use of standardized order sets and increased adherence to standard of care guidelines compared to handwritten orders. Specifically, it was able to show that errors*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
SOS: 77.8 No SOS: 83.3 P = 1 **Free flap, %** SOS: 44.1 No SOS: 69.4 P = 0.0526 **Thyroidectomy, %** SOS: 67.6 No SOS: 72.2 P = 1 **Laryngopharyngectomy, %** SOS: 29.4 No SOS: 47.2 P = 0.147 **<u>Primary Outcomes</u>** **Errors in orders, %** SOS: 38.2 No SOS: 80.6 P = 0.0005 ***Subgroup analyses*** **Inappropriate antibiotic orders, %** SOS: 14.7 No SOS: 41.7 P = 0.0173 **Inappropriate mechanical deep vein thrombosis prophylaxis,** SOS; 0 No SOS: 36.1 P < 0.0001 Hypothyroidismprophylaxis, P = 0.201 Referrals to allied health professionals, P = 0.112 Individual numbers NR **<u>Secondary Outcomes</u>** **Post-operative complications** P > 0.05 for all **Fistula, number** SOS: 8 No SOS: 9 P = 0.783 **Surgical revision, number** SOS: 8 No SOS: 9	*were being commit-ted with increased frequency when standardized postoperative orders were not used. Subgroup analysis also determined that adherence to antibiotic prophylaxis and DVT prophylaxis proto-cols were statistically significant when a standardized order set was used."* (*p*S108)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
P = 0.783 **Thromboembolic disease, number** SOS: 1 No SOS: 0 P = 1 **Salivary bypass tube, number** SOS: 1 No SOS: 2 P = 0.6087 **Death, number** SOS: 0 No SOS: 1 P = 0.4857 **One or more complications, number of cases** SOS: 13 No SOS: 15 P = 0.6262 **LOS, mean, days** SOS: 18.6 No SOS: 18.6 P = NA	
Flood 2018 [12]	
Demographics N = 80 SOS group n = 30 Control n = 50 **Age (years), SOS group vs. control** 11.1 vs. 12.1, P = 0.93 **Sex (% female), SOS group vs. control** 63.3% vs. 56.0%, P = 0.51 No significant differences in location of presentation, initial site of admission, or biochemical profile **Outcomes** **Receipt of initial IV bolus prior to insulin treatment** Control: 92% SOS: 96.7% P = 0.78 **Fluid bolus volumes of ≤20 mL/kg** Control: 83% SOS: 76% P = 0.03	*"Improvement in DKA management at our centre was achieved through the development and implementation of an evidence guided pediatric DKA order set. Ongoing assessment, revision and expansion of the order set are predicted to improve the quality and safety of DKA care for pediatric patients throughout the province"* (*p*303)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
72% of control patients outside of target IV fluid range received less than target fluid replacement rates **Receipt of recommended 40 mEq/L of potassium chloride to initial IV fluids** Control: 40% vs. SOS: 79.3% P = 0.0007 **Number of episodes of moderate or severe hypokalemia** Control: 10% vs. SOS: 6.7% P = 0.70 **Administration of dextrose to IV fluids at or prior to serum glucose <17 mmol/L** Control: 67.4% SOS: 93.1% P = 0.009 **Episodes of hypoglycemia** Control: 6.1% SOS: 3.4% P = 0.99 **Intervention(s) for: suspected cerebral edema** Control: 4.0% SOS: 6.7% P = 0.62 **Bicarbonate use, (number of patients)** Control: 2 SOS: 0 **Decreases of insulin infusion rates < 0.5 units/kg/h or sliding-scale use prior to DKA resolution** Control: 6 SOS: 3 **Mannitol/hypertonic saline use** Control: 1 SOS: 1	
Gulati 2018 [14]	
<u>Demographics</u> N = 250 SOS n = 72 Control n = 178 **Age, mean (years ± SD)**	*"We have demonstrated the real-world applicability of using a standardized EHS-based intervention on reducing corticosteroid exposure and hospital LOS in managing patients hospitalized with AECOPD without adversely affecting hospital readmissions.*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Whole cohort: 62 ± 11 (in text), 69 ± 11 (in table) SOS: 69 ± 12 Control: 70 ± 8 P = 0.848 **Sex, male (%)** Whole cohort: 58% males SOS: 33% *(Note: written as 33%, but 38/72 participants, so likely intended to read 53%)* Control: 65% P = 0.289 **Ethnicity** Whole cohort: 71% white SOS: 68% Control: 73% P = 0.446 **FEV1, mean (% predicted ± SD)** Whole cohort: 55.1% ± 23.6% SOS: 49% ± 19% Control: 56% ± 24% P = 0.089 Significant difference in numbers of participants with ≥1 AECOPD within the previous 12 months and smoking pack years. No significant difference in hypertension, diabetes, CHF, coronary artery disease, obstructive sleep apnea Spirometry data available in 70% of the patient population (66% [118/178] in the SOS and 78% [56/72] in the control group, P=0.07). **<u>Outcomes</u>** **Cumulative steroid dose, mean (mg ± SD)** SOS: 420±224 Control: 611±462 P < 0.001 **Days of total systemic corticosteroids, (mean ± SD)** SOS: 9.6 ± 5.5 Control: 13 ± 15.6 P = 0.075 **LOS, median (days)** SOS: 3 (IQR 2 to 4) Control: 4 (IQR 3 to 6) P = 0.02 SOS independently associated with LOS (beta = –0.92, P = 0.006), when adjusted for age, sex, race, and smoking status. **All-cause hospital readmission, (%), SOS vs. control** 30 days: 25% vs. 25%, P = 0.96	*These findings suggest health systems can safely adopt EHS-based COPD treatment plans using currently accepted standard treatment regimens."* (p2276)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
90 days: 44% vs. 38%, P = 0.37 **Time until readmission (mean)** SOS: 90 days Control: 93 days HR = 1.31, 95% CI 0.86 to 1.99, P = 0.21	
Lau 2018[18]	
Demographics N = 83 CMOS, n = 56 Control n = 27 **Sex (n), CMOS vs. control** Female: 26 vs. 17 Male: 30 vs. 10 P = 0.16 **Age (mean ± SD, range)** CMOS: 76.6 ± 13.3, 47 to 94 Control: 73.9 ± 20.6, 31 to 101 P = 0.49 Type of service, disease, time of consult until death, number of days all non-significantly different between groups **Involvement of spiritual care significantly different between groups, CMOS vs. control (%)** 66 vs. 19, P = 0.00005 **Outcomes** **Adjustments to symptom management (mean)** CMOS: 1.7 Control: 3.3 P = 0.00014 Patient comfort status (%) CMOS vs. Control "Comfortable": 85 vs. 68, P = 0.11 No documentation: 7.1 vs. 18.5, P = NR Most frequent symptom contributing to discomfort in both groups was dyspnea, greater in the control group (P = NR) 87% of the time actions were completed if a patient was not comfortable, regardless of group	*Overall, the CMOS is a useful strategy in improving processes in EOL care in an inpatient setting, though not fully sufficient. This study represents a preliminary review of several areas that the CMOS may address in promoting more comprehensive EOL care, particularly around assessment of symptoms and management of existential distress."* (*p*659) *"This study reveals that with use of the CMOS, there was a statistically significant increase in the number of referrals to spiritual care for assistance with psychosocial and spiritual suffering along a patient's continuum of disease"* (*p*658)
Pendharkar 2018 [19]	

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Demographics N = 1413 SOS, n = 406 - Respirologists n = 33 - General internists n = 59 - Hospitalists n = 314 Control, n = 451 - Respirologists n = 64 - General internists n = 148 - Hospitalists n = 239 **Age, years ± SD** SOS: 70 ± 12 Control: 70 ± 12 P = 0.747 **Sex, %** Male, SOS: 52.3 Male, control: 50.2 P = 0.441 No significant differences between groups for comorbidities **Admitting speciality, (%), SOS vs. control** Respirologist: 11.3 vs. 9.2 General internist: 24.2 vs. 16.6 Hospitalist: 64.5 vs. 74.3 P = 0.0005 *"Patients with co-existing heart failure and diabetes were more commonly admitted under general internists." Page 3* **Primary Outcome** Order set use increased gradually post-implementation **LOS, median (days)** SOS: 6.37 (95% CI 5.94, 6.81) Control: 6.02 (95% CI 5.59, 6.46) P = 0.26 Overall difference (adjusted): −0.39 (95% CI −0.94, 0.15), P = 0.156 Overall difference (unadjusted): −0.36 (95% CI −0.87, 0.15), P = 0.164 **Difference in LOS, median (days)** Unadjusted difference of 1.15 fewer days (95% CI −0.50, −1.81, P = 0.001), favouring SOS group Adjusted difference of 0.73 fewer days (95% CI −1.40, −0.07, P = 0.031), favouring SOS group In hospitalist group, unadjusted difference of 1.78 days (95% CI −0.95, −2.61), favouring SOS group In hospitalist group, unadjusted difference of 1.78 days (95% CI −0.95, −2.61), favouring SOS group	*"In conclusion, this study found that when a standardized electronic order set was used to admit patients with AECOPD, LOS was reduced without increasing readmissions. Innovations such as order sets have the potential to lessen the burden of AECOPD hospitalizations on both patients and the healthcare system, and justify additional studies of clinical decision support tools for AECOPD."* (*p7*)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
No significant difference in respirologist or general internists group, for either unadjusted (95% CI −2.67, 4.47 and −1.66, 2.02 respectively) or adjusted (95% CI −1.18, 4.22 and −1.39, 2.56 respectively) **Secondary Outcomes** **Mortality, (%), SOS vs. control** 3.6 vs. 3.4, P = 0.842 **Readmissions, (%), SOS vs. control** 7 days: 7.0 vs. 5.9, P = 0.430 30 days: 19.4 vs. 16.4, P = 0.153 90 days: 34.9 vs. 30.6, P = 0.093 Adjusted OR (post vs. pre-implementation): 1.16 (95% CI 0.87, 1.55) Adjusted OR (SOS vs. no SOS**): 1.17 (95% CI 0.87, 1.59) **ED visits, (%), SOS vs. control** 7 days: 6.4 vs. 7.6, P = 0.409 30 days: 22.9 vs. 22.3, P = 0.803 Adjusted OR (post vs. pre-implementation): 1.03 (95% CI 0.8, 1.34) Adjusted OR (SOS vs. no SOS**): 1.07 (95% CI 0.82, 1.41) **SOS vs. no SOS was a comparison of the use of SOS by attending physicians	
Brown 2016 [10]	
Demographics N = 275 Pre-implementation (1 year) n = 194 Post-implementation (6 months) n = 81 *Note: admissions are the unit of measurement in this study* **Age, mean (years ± SD)** SOS: 69.9 ± 10.2 Control: 70.2 ± 10.2 P = NR **Sex, male (%)** SOS: 98.1% Control: 94.1% P = NR **FEV1, mean (% predicted ± SD)** SOS: 49.4% ± 19.5% Control: 52.8% ± 19.9% P = NR **Outcomes** **COPD hospitalizations with zero physician prescribing errors, (%)**	*"The implementation of a comprehensive, multidisciplinary order set embedded in the EHR improved physician prescribing adherence to evidence-based therapies for patients hospitalized for COPD exacerbations, and it was associated with reductions in length of hospital stay. Factors critical to the success of this intervention included multidisciplinary input, physician leadership in development, promotion, revision, order entry efficiency, and user friendliness. Further research is needed to determine the effect of COPD order sets in the EHR on clinical outcomes, including recurrent exacerbations and readmissions."* (*p*814)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
SOS: 54.3% Control: 18.6% P < 0.001 **Physician prescribing errors per hospitalization, number (mean)** SOS: 0.65 Control: 1.76 P < 0.001 **Physician prescribing errors, (%), SOS vs. control** Antibiotics: 16% vs. 39%, P < 0.001 Systemic corticosteroid prescribing: 28% vs. 58%, P < 0.001 Short-acting bronchodilator: 2.5% vs. 13.9% (P = 0.005) **Discharge without prescription for long-acting bronchodilator, (%)** SOS: 7.4 Control: 16.5 P = 0.047 **Discharge without prescription for inhaled corticosteroid, (%)** SOS: 9.9 Control: 18 P = 0.089 **LOS, days ± SD** SOS: 2.9 ± 1.9 Control: 4 ± 3 P = 0.002 **Adverse clinical outcomes, %, no SOS vs. SOS** Rates of unscheduled physician visits: 2.1% vs. 2.5%, P = 0.84 Emergency department visits: 15.5% vs. 12.3%, P = 0.48 Rehospitalizations: 23.2% vs. 21%, P = 0.65 Deaths: 2.6% vs. 0%, P = 0.14	
Ballard 2015[9]	
<u>Demographics</u> N = 10,081 CPOE-EHR n = 6686 ED stroke order set n = 3677 ED stroke order set not used n = 3009 **Age, median (IQR)** SOS: 76 (19) No SOS: 77 (18) P = NR **Sex, male, number (%)** SOS: 1902 (51.7) No SOS: 1615 (53.7) P = NR	*"In our supplemental analysis, we observed a lower risk of inpatient pneumonia and a mortality benefit at 30 to 90 days post-admission amongst patients in which the CPOE ED stroke order set was used." Page 9* *"In summary, during a staggered implementation of a CPOE-EHR across medical centers within a large integrated health system, the availability of a CPOE-EHR with an ED stroke order set and specific use of this order set was associated with increased use of IV tPA."* (*p*10)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
SES, "non-low SES", number (%) SOS: 2780 (75.6) No SOS: 2157 (71.7) **Ethnicity (%), SOS vs. No SOS** White: 66.3 vs. 69.3 Black: 9.5 vs. 9.8 Hispanic: 7.8 vs. 7.8 Asian: 13.7 vs. 10.9 Other: 2.7 vs. 2.2 P = NR **Documented mNIHSS unknown, SOS vs. no SOS, %** 3.5% vs. 12.5% **Documentation of dysphagia, SOS vs. no SOS, %** 96.9 vs. 75.6 **Outcomes** **IV tPA in ED, rate difference with order set, % (95% CI)** 8.0% (6.4%, 9.5%) **Pneumonia, rate difference with order set, % (95% CI)** −2.6% (−4.0%, −1.2%) **In-hospital mortality, rate difference with order set, % (95% CI)** −0.5% (−1.5%, 0.5%) **7-day, mortality rate difference with order set, % (95% CI)** −0.8% (−1.9%, 0.3%) **30-day mortality, rate difference with order set, % (95% CI)** −1.7% (−3.2%, −0.2%) **60-day mortality, rate difference with order set, % (95% CI)** −2.6% (−4.3%, −0.9%) **90−day mortality, rate difference with order set, % (95% CI)** −2.9% (−4.7%, −1.1%)	
Dayal 2015 [11]	
Demographics N = 1558 Pre-implementation (no SOS, primary outcomes) n = 870 Post implementation (SOS, primary outcomes) n = 688 Pre-implementation (pharmacy inventory data) n = 457 Post implementation (pharmacy inventory data) n = 439	*"Pediatric evidence-based order sets can add value to pediatric units within adult community hospitals by decreasing the use of unnecessary therapies and lowering LOS while having minimal effect on 30-day readmission rates.23 This is the first article to our knowledge to specifically look at the impact of order sets and pathways on*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Age: NR **Sex: NR** **Hospital LOS** **Asthma + Bronchiolitis + Pneumonia (overall), days** No SOS: 2.19 SOS: 1.86 P < 0.05 **Asthma, days** No SOS: 1.9 SOS: 1.45 P < 0.05 **Bronchiolitis, days** No SOS: 2.37 SOS: 2.04 P < 0.05 **Pneumonia, days** No SOS: 2.30 SOS: 2.10 P = 0.083 **30 days readmission** **Asthma + Bronchiolitis + Pneumonia (overall), %** No SOS: 3.0 SOS: 2.2 P = 0.344 **Asthma, %** No SOS: 0.03 SOS: 0.02 P = 0.571 **Bronchiolitis, %** No SOS: 4.8 SOS: 2.8 P = 0.420 **Pneumonia, %** No SOS: 2.5 SOS: 2.2 P = 0.807 **Average number of medications per patient, SOS vs.no SOS** Albuterol nebulizer: 5.14 vs. 10.7 Levalbuterol: 0.19 vs. 1.99 **Costs**	*several pediatric respiratory diagnoses within that setting. Within the current environment in which community hospitals face increased pressure to improve quality while concurrently being tasked to reduce resource utilization, order sets and pathways can streamline work processes to optimize effectiveness, quality, and cost-efficient care delivery."* (p627)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Mean total hospital utilization cost per patient with asthma Pre-implementation: $2010 Post-implementation (January 2011–December 2011): $1174 *Note: Assuming US dollars. Currency not stated in report.*	
Hall 2015[15]	
Demographics N = 597 CPOE n = 377 Pre CPOE n = 220 **Age, mean ± SD, years** CPOE: 61.7 ± 18.6 Pre CPOE: 60.7 ± 18.5 **Sex, male, %** CPOE: 52.8 Pre CPOE: 53.6 **Weight, kg ± SD** CPOE: 88.2 ± 32.2 Pre CPOE: 82.9 ± 27 **Outcomes** **Appropriate initial dose, overall, %, pre CPOE vs. CPOE** All patients: 45 vs. 67, P < 0.0001 Critically ill patients; 28 vs. 45, P = 0.0441 **Initial dose per indication, mean ± SD, pre CPOE vs. CPOE** Overall mean dose: 14.6 ± 4.9 vs. 17.4 ± 5.7, P <0.0001 Skin and soft tissue: 13.0 ± 4.6 vs. 16.3 ± 5.7, P < 0.0001 Pulmonary: 15.3 ± 4.5 vs. 18.1 ± 5.5, P = 0.0031 Sepsis: 17.5 ± 4.7 vs. 18.0 ± 5.4, P = 0.72 Urinary tract: 14.4 ± 5.4 vs. 17.9 ± 6.2, P = 0.046 Others: 14.8 ± 4.8 vs. 18.0 ± 5.7, P = 0.0014 **Initial dose by weight, mean ± SD, pre CPOE vs. CPOE** <50 kg: 23.1 ± 3.6 vs. 25.7 ± 5.7, P = 0.107 50-75 kg: 17.0 ± 3.4 vs. 20.1 ± 4.8, P < 0.0001 76-100 kg: 13.5 ± 3.7 vs. 16.9 ± 4.2 P < 0.0001 >100 kg 9.6 ± 3.1 vs. 12.9 ± 4.4, P <0.0001	*"The use of standardized order sets offers an opportunity for organizations to influence prescribing patterns and guide clinicians to participate in evidence-based practice. The adoption of an electronic order set resulted in significant improvement in appropriate initial vancomycin doses in ED patients in addition to those deemed critically ill. The impact of increasing compliance to vancomycin dosing recommendations is in accordance with stewardship principles that promote optimization of antimicrobial dosing based on individual patient characteristics and pharmacokinetic parameters. More studies are needed to assess the relationship between appropriate initial vancomycin doses in the ED and the impact on therapeutic outcomes."* (*p*94)
Krive 2015 [17]	
Demographics **No demographic data reported**	*"This study quantitatively analyzed effectiveness of evidence-based CPOE ordering practices for pneumonia patients,*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
SOS (mortality) n = 362 No SOS (mortality) n = 4725 SOS (readmissions) n = 556 No SOS (readmissions) n = 4531 SOS (LOS) n = 362 No SOS (LOS) n = 4725 SOS (comorbidity) n = 556 No SOS (comorbidity) n = 4427 *Note: sample sizes differ due to availability of records* **Outcomes** **Mortality, %** SOS: 6.6 No SOS: 11.3 OR = 1.787 (95% CI 1.170 to 2.730), Chi squared test, P = 0.061 Two-sided fisher's exact test, P = 0.05 **30-day hospital readmissions, %** SOS: 10.8 No SOS: 14.7 OR = 1.362 (95% CI 1.015 to 1.827), P < 0.05 Chi squared test, P = 0.039 Two-sided fisher's exact test, P = 0.041 **LOS, days** SOS: 4.32 No SOS: 4.79 P = 0.009 *Results remained consistent when patients who had died were removed from the analysis* **Comorbidities/Complications** CCI score, mean SOS: 2.13 No SOS: 2.40 One-way ANOVA P = 0.015 Mann Whitney U test P = 0.014	*measured by mortality, 30-day readmissions, and length of stay health outcomes. The study demonstrates a potentially strong correlation between evidence-based CPOE ordering practices and health outcomes from treating pneumonia. We find that the utilization of order sets to prescribe medications in these cases is beneficial and serves as a sufficient starting point for warranting physician participation in further studies, increasing utilization of the order sets in hospitals, and initiating more narrow focused studies that allow for greater variable control and more granular data collection."* (*p*12)
Valgardson 2015 [20]	
Demographics SOS n = 302 (number of admissions) No SOS n = 274 (number of admissions) **Age, mean ± SD, years** 62.3 ± 15.4 62.3 ± 15.8	*"The main finding of this study was that the implementation of inpatient insulin order sets using human insulins among non-ICU patients was associated with increased use of recommended BBC insulin and with decreased use of the less preferred sliding-scale insulin monotherapy regimens.*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Sex, male, % SOS: 48.7 No SOS: 44.5 **LOS, mean ± SD, days** SOS: 6.0 ± 5.8 No SOS: 6.3 ± 4.9 **Hospital service, %, SOS vs. no SOS** Internal medicine: 73.5 vs. 79.5 Surgery/Orthopedics/Gynecology: 26.5 vs. 20.4 **Use of corticosteroids, %** SOS: 13.9 No SOS: 16.1 **HA_{1C} %, mean ± SD** SOS: 8.5 ± 2.3 No SOS: 8.8 ± 2.5 **Primary Outcome** **Ordering of the preferred combination of BBC insulin regimen, %, all services combined** SOS: 27.5 No SOS: 10.6 P < 0.001 **Patients not prescribed insulin, %** SOS: 8.6 No SOS: 14.2 P = 0.04 **Use of sliding-scale insulin monotherapy, %** SOS: 36.1 No SOS: 28.8 P = 0.06 **Use of 70/30 premixed insulin with correction, %** SOS: 7 No SOS: 15 P = 0.003 **Use of any basal with mealtime and correctional insulin, %** SOS: 31.5 No SOS: 11.3 P < 0.001 **Prescribing of any basal insulin (with or without nutritional), %** SOS: 62.6 No SOS: 49.6 P = 0.002 **Use of oral antihyperglycemic agents, %** SOS: 14.9 No SOS: 24.1% P = 0.006	*It was also associated with other changes in ordering behavior, including an increase in appropriate checks of hemoglobin A1c and a decrease in the use of oral antihyperglycemic agents"* (p798)

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
Evaluation of HA_{1C}, % SOS: 62.3 No SOS: 50.0 P = 0.003 **<u>Secondary Outcomes</u>** **Daily blood glucose, mean,** Significant at day 8 (P < 0.05) Day 3, day 7 (P < 0.10), all other P values NR **Blood glucose decrease, days 3 to 9, difference between SOS and no SOS** **–**14.4 mg/dL (95% CI –2.2 to –26.5 mg/dL) P = 0.020 No significant change in the incidence of moderate hypoglycemia (P = 0.15) or severe hypoglycemia (P = 0.38)	
Krive 2014[16]	
<u>Demographics</u> **No demographic data reported** SOS (mortality) n = 719 No SOS (mortality) n = 10219 SOS (readmissions) n = 538 No SOS (readmissions) n = 7583 SOS (LOS) n = 719 No SOS (LOS) n = 10219 SOS (comorbidity) n = 525 No SOS (comorbidity) n = 7232 *Note: sample sizes differ due to availability of records* **<u>Outcomes</u>** **Mortality, %** SOS: 1.8 No SOS: 3.2 OR = 1.818 (95% CI 1.039 to 3.181) Chi squared test, P = 0.034 Two-sided fisher's exact test, P = 0.04 **30-day hospital readmissions, %** SOS: 20 No SOS: 19 OR = 0.913 (95% CI 0.734 to 1.137) Chi squared test, P = 0.417 Two-sided fisher's exact test, P = 0.424	*However, comparison of the "order set" and "free text" groups and statistical significance of the mortality outcome point to the fact that CHF ordering via sets has potentially strong influence on this health outcome… The study did not establish statistical link between utilization of CHF order sets and 30-day readmissions. Yet, the length of hospital stay was almost one day shorter for patients in the "order set" group, indicating wide implications of the study for the cost cutting and patient satisfaction improvement efforts – without a corresponding reduction* in mortality."* (p823) **Note: mortality decreased significantly in this study. This may have been a typo.*

Table 4: Summary of Findings of Included Primary Clinical Studies

Main Study Findings	Authors' Conclusion
LOS, days SOS: 4.75 No SOS: 5.46 P = 0.004 *Results remained consistent when patients who had died were removed from the analysis* **Comorbidities/Complications** CCI score, mean SOS: 3.64 No SOS: 3.68 One-way ANOVA P = 0.585 Mann Whitney U test P = 0.23	

ANOVA = analysis of variance; BBC = basal-bolus with correctional insulin; CCI = clinical comorbidity score; CDST = clinical decision support tool; CI = confidence interval; CMOS = comfort measures order set; DKA = diabetic ketoacidosis; EHR = electronic health record; EN = enteral nutrition; FEV1 = forced expiratory volume; HA_{1c} = hemoglobin a1c; IV = intravenous; IQR = interquartile range; LOS = length of stay; mNIHSS = modified National Institutes of Health Stroke Scale; NA = not applicable; NR = not reported; OR = odds ratio; PICU = pediatric intensive care unit; PRISM = Pediatric Risk of Mortality; QI = quality initiative; SD = standard deviation; SES = socioeconomic status; SOS = standardized order set; tPA = tissue plasminogen activator

Appendix 5: Additional References of Potential Interest

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